Synopsis of Proposed Research Work

Entitled

"An Approach To Fuzzy Transportation Problem Using Different Ranking Methods"

Submitted to

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

For the award of Ph. D. degree in the subject

Mathematics

Under the faculty of

SCIENCE

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Abstract of proposed work plan:

An Approach To Fuzzy Transportation Problem Using Different Ranking Methods"

1. Introduction

• Origin of the research problem:

Transportation Problem is an important problem which has been widely studied in Operations Research domain. It has been often used to simulate different real life problems. Transportation problems is applied if there are more than one center called origin from where the goods need to be shipped, more than one places called destinations and the costs of shipping from each of the origins to each of destinations being different and known the problem is to ship the goods from various origin to different destination in such manner so that the cost of shipping or transportation is minimum.

The idea of fuzzy set was first proposed by Zadeh, as a mean of handling uncertainty that is due to imprecision rather than to randomness. After that Bellman and Zadeh proposed that a fuzzy decision might be defined as the fuzzy set, defined by the intersection of fuzzy objective and constraint goals. From this view point, Tanakka and Asai, Zimmermann introduced fuzzy linear programming problem in fuzzy environment. Tong, Gasimov and Yenilmez among others, considered single objective mathematical programming with all fuzzy parameters. Tong considered the fuzzy linear programming problem with fuzzy constraints. After defuzzification he solved the so-obtained crisp problem by fuzzy decisive set method proposed by Sakawa and Yano. Gasimov and Yenilmez considered fuzzy linear programming (FLP) problem with less than type constraints. In their paper coefficients of constraints were taken as fuzzy numbers. They

solved it by fuzzy decisive set method and modified sub-gradient method. Chanas, proposed a fuzzy programming in multi-objective linear programming and it was solved by parametric approach. Zimmermann proposed a fuzzy multicriteria decision making set, defined as the intersection of all fuzzy goals and constraints.

• Interdisciplinary relevance:

A fuzzy number can account for a partial description of a system for example problem of the evaluation of a color. From the physicist's point of view, that particular color is uniquely represented by the frequency of an electromagnetic wave. They use a fuzzy concept since it involves aspects of perception and semantics very good. Similarly concepts in quantum mechanics such as ambiguity and vague measurements can be formalized in the language of fuzzy number.

In Electronic Science composition of fuzzy relation to suggest the resistor for long life is solved successfully on MATLAB. Using the method composition of fuzzy relation the exactness of system parameters can be obtained perfectly as compared with solving method on paper. Also fuzzy proposition are equivalent to Logic gates in Electronics Circuits.

In Chemical Science fuzzy logic is a design methodology that can be used to solve real life problems. Chemical engineering has employed fuzzy logic in the piping risk assessment, safety analysis, batch crystallizer, combustion process, Food Produce, fluidized catalytic cracking Unit and separation Process.

In Biomedical Science fuzzy logic play vital role in the field of drug designing, bioinformatics, management of diseases, clinical trials. All of these directly or indirectly affect the life.

2. Review of Literature and Development in the subject (Previous work done in the relevant area):

Some Computation Method:

i) By using Modi Method:

To find initial basic solution for any given transportation problem we first apply NWCR or Matrix Minima Method or Vogel's Approximation method and then find optimum solution by using MODI method.

ii) By using Fuzzy number:

Convert all possible cost, demand and supply to fuzzy number (Triangular, Trapezoidal, Pentagonal and Hexagonal) find the solution of given transportation problem using addition, subtraction, multiplication and division of fuzzy numbers.

iii) MATLAB:

By using random fuzzy number and MATLAB program find optimum feasible solution.

iv) Transportation Problem:

Assume there are m sources and n destinations. Let x_{ij} be the amount to be shipped from source i to destination j, $1 \le i \le m$, $1 \le j \le n$. x_{ij} will be an integer greater than, or equal to zero. Also let a_i be the amount of supply at source $i = 1, ..., m$ and b_j the demand at destination $j = 1, ..., n$. The unit Transportation cost from source i to destination j is c_{ij}, $1 \le i \le m$, $1 \le j \le n$.

The linear programming model is

$$Minimize\ Z = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij}\ X_{ij}$$

Subject to

$\sum_{i=1}^{m}$ $X_{ij} \ge b_j$ j = 1, 2, 3… n

And

$\sum_{j=1}^{n} X_{ij} \leq a_i$ i = 1, 2, 3… m

and $x_{ij} \geq 0$ and x_{ij} integer. For the model to be feasible we must have the total supply is at least equal to the total demand

$\sum_{i=1}^{m} a_i \geq \sum_{j=1}^{n} b_j$

v) Fuzzy Transportation Problem:

Now we allow some, or all, of the parameters $c_{ij,}$ a_i and b_j to be fuzzy showing any uncertainty in their values. However, the x_{ij} will be crisp because if we allowed them to be fuzzy we would have to de fuzzify them at the end to obtain a feasible shipping plan. Let $\bar{C}_{ij}$ be a fuzzy number representing the cost of sending one unit from source i to destination j. $\bar{A}_i$ is a fuzzy number for the amount at source i and $\bar{B}_j$ is another fuzzy number for the demand at destination j. Some of these parameters may be crisp. Then the fuzzy optimization problem to solve is

Minimize $\bar{Z} = \sum_{i=1}^{m} \sum_{j=1}^{n} \bar{C}_{ij}\ x_{ij}$

Subject to

$\sum_{i=1}^{m} x_{ij} \geq \bar{B}_j$ j = 1, 2, 3… n.

And

$\sum_{j=1}^{m} x_{ij} \leq \bar{A}_i$ i = 1, 2, 3… m.

and $x_{ij} \geq 0$ and x_{ij} integer. For the model to be feasible we must have the total supply is at least equal to the total demand

$\sum_{i=1}^{m} \bar{A}_i \geq \sum_{i=1}^{n} \bar{B}_j$.

- **International status**

1. ***George J. Klir And Bo Yuan* (1988)** elaborated the importance of fuzzy mathematics. This research is a natural extension of Fuzzy Sets and Uncertainty by George J. Klir and Tina A. Folger. It reflects the remarkable advances that have taken place in the areas of fuzzy logic and fuzzy set theory during the period 1988-1995. The main purpose is to simplify education in the increasingly important areas of fuzzy set theory and fuzzy logic.
2. ***J. Buckley and Leonard J. Jowers* 2006)** developed 'Monte Carlo Method in Fuzzy Optimization' they have given very detailed information about fuzzy optimization techniques by using Monte Carlo Method. They introduced Monte Carlo method to find proper approximate solutions to fuzzy optimization problems. Many crisp (non-fuzzy) optimization problems have algorithms to determine solutions. This is not true for fuzzy optimization.
3. ***Timothy J. Ross.* (2011)** gives the technological advancement of fuzzy set theory and its application to systems, using fuzzy logic. Improvements in other theories, for instance, evidence theory and possibility theory, have revealed more insight into the genuine ideals of fuzzy logic applications, and some advances in machine computation have made certain highlights of fuzzy logic significantly more helpful than previously. It is reasonable to express that a few improvements in fuzzy systems are reasonably competitive with other, linear algebra-based methods in terms of associated accuracy and computational speed.
4. ***Hongxing, Phili D.Ghen and Han-Pang Huang*(2012)**offer researchers, students, scientists and engineers involved in a systematic and neural

networks, fuzzy neural integrated systems, fuzzy systems, comprehensive structure of theories and its applications. They explain the Fuzzy systems and neural networks have been observed as the central branches of soft computing. The purpose was to take the benefit of neural network methods to create or to improve a fuzzy system. They additionally talked about the most recent outcomes of a neuro-fuzzy system is nothing but the combination of fuzzy systems and neural networks.

- **National Status**

1. **Bablu Jana and Tapan Kumar Roy (2010)** applied Multi-Objective Fuzzy Linear Programming to solve Transportation Model.
2. **A. NagoorGani and K. Abdul Razak (2011)** converted crisp transportation problem to fuzzy transportation problem by using trapezoidal fuzzy number. They do not fully fuzzify the transportation number. Only demand and supply are trapezoidal fuzzy number.

3. Debashis Dutta and A.Satyanarayana Murthy(2012)applied multi-choice Goal Programming approach for a Fuzzy Transportation Problem.

4. S. Mohanaselvi and K. Ganesan (2013) found fuzzy optimal solution to fuzzy transportation problem by ranking function.

5. **John N. Mordeson, Premchand S. Nair's(2014)** research work in 'Fuzzy Mathematics' deals with fuzzy geometry, fuzzy graph theory, fuzzy abstract algebra and fuzzy topology. The main aim of this work was to present the concepts of fuzzy mathematics from these areas which have applications to mathematical science, engineering, and other branch of sciences.

6. **P. Malini and Dr. M. Ananthanarayanan (2016)** explained a new method to order generalized fuzzy trapezoidal numbers in their article ‘Solving Fuzzy Transportation Problem using Ranking of Trapezoidal Fuzzy Numbers'. Authors illustrate proposed method with example. This new ranking method is very easy to understand and using this ranking method, it is simple to find the fuzzy optimal solution of fuzzy transportation problems arising in the real life situations.

3. Objectives of Research/ Proposed Hypothesis:

1) Convert crisp transportation problem to fully fuzzify transportation problem by using Triangular, Trapezoidal, Pentagonal, Hexagonal fuzzy numbers and try to work out following points.

- Study the different types of fuzzy numbers.
- Initial Basic Feasible Solution.
- Optimum Solution.

2) Apply MATLAB program and try to work out following points

- Convert the given crisp transportation problem to linear programming problem (LPP).
- Convert the given crisp transportation problem to Fuzzy linear programming problem (LPP).
- Study different type of random number generator.
- Generate different dimensional random number.
- Using MATLAB try to find out optimum solution of given fuzzy transportation problem.
- Also we try to extend above points for various type of fuzzy number. We prepare MATLAB program to compute optimum Solution.

3) To investigate some problems such as existence, uniqueness and other properties of the solutions of fuzzy transportation problem

4) Analysis of fuzzy transportation problem by using various techniques to study its applications to mathematical sciences, engineering, technology business and everyday life.

4. Methodology to be adopted:

1. Collection of relevant literature from good libraries in India and abroad.
2. Generate three dimensional random number then Triangular, Trapezoidal, Pentagonal, Hexagonal random fuzzy number etc.
3. Using triangular, Trapezoidal, Pentagonal, Hexagonal etc. fuzzy numbers to solve crisp transportation problem.
4. Generate MATLAB Program find solution to given fuzzy transportation problem.
5. Consultations with expertise on topics relevant to proposed work.
6. Publishing original work.

5. Importance of study/ Society application:

In this work we are going to use fuzzy mathematics method to determine approximate solutions to a fuzzy transportation problem. First we fuzzify it and apply MATLAB method to generate approximate solutions. When a financial instrument or asset is being analyzed to label its value, many complex equations, the values of which may be uncertain, are used to reach a final answer. Since MATLAB method work well with highly complex equations, their use becomes vital in the calculation of uncertain values, which then in turn help analyze the final value of the instrument or asset in question. The study proposes a framework incorporating the Fuzzy Transportation approach to analyze the project completion probabilities among various time/cost constraints.

- **Significance of the study**

The aim of this work develops a Matlab program for fuzzy linear programming method for solving the transportation planning decision problems with fuzzy goals, available supply and forecast demand. The proposed method attempts to minimize the total production and transportation costs and the total delivery time with reference to available supply and machine capacities at each source, as well as forecast demand and warehouse space constraints at each destination. An industrial case is used to demonstrate the feasibility of applying the fuzzy linear programming method to a real transportation planning decision problem. In real world transportation planning, decision problems, input data and related parameters, such as available supply and forecast demand, are often imprecise/fuzzy because some information is incomplete or unobtainable. Also, the decision maker must simultaneously handle conflicting goals that govern the use of the constrained resources within organizations.

6. Proposed work Plan/ Formulation and Structure of Study:

Year-wise Plan of work and targets to be achieved

Sr.No	Year	Plan of work/Expected target to be achieved
1)	First Year	In depth literature search and problem investigation for transportation problem and fuzzy transportation problem.
		Generate various type of random number and then generate Triangular, Trapezoidal, Pentagonal, Hexagonal fuzzy number
2)	Second Year	Convert crisp transportation into fuzzy transportation problem
		Solve the fuzzy transportation problem by using Triangular, Trapezoidal, Pentagonal, Hexagonal fuzzy numbers.

3)	Third Year	Solve the fuzzy transportation problem using MATLAB
		Result, comparison, discussion and conclusion, publication about project work

7. References:

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